7. If thin metal screens are used to sift the cathode rays the luminescent phenomena change. The rays of least penetrating power appear to be most susceptible to magnetic and electrostatic forces. The various constituents of a heterogeneous cathode beam are emitted in various proportions at different degrees of exhaustion. In the cathode rays emitted at higher degrees of exhaustion there is a greater proportion of the less-deflectable rays. The least-deflectable rays are those which most readily penetrate through a perforated screen when that screen is itself made cathodic.

When ordinary cathode rays fall upon a perforated screen which is itself made cathodic, or are attempted to be passed through a tubular cathode, there emerge beyond the screen or tube some rays, here termed dia-cathodic rays, which differ from the ortho-cathodic, and also from the para-cathodic rays. These dia-cathodic rays are not themselves directly deflected by a magnet. They show themselves as a pale blue cone or streak. Where they fall on the glass they do not excite the ordinary fluorescence of the glass. The dia-cathodic rays excite, however, a different or second kind of fluorescence; the tint in the case of soda-glass being a dark orange. Intervening objects in the beam or cone of dia-cathodic rays cast shadows. The orange fluorescence evoked on soda-glass by the dia-cathodic rays shows in the spectroscope the D lines of sodium only. The shadows cast by dia-cathodic rays are not deflected by the magnet, nor do they change their size when the object is electrified.

"Electrification of Air, of Vapour of Water, and of other Gases."

By Lord Kelvin, G.C.V.O., F.R.S., Magnus Maclean, D.Sc., F.R.S.E., and Alexander Galt, B.Sc., F.R.S.E.
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(Abstract.)

§ 1. In this paper the authors describe a long series of experiments on the electrification of air and other gases with which they have been occupied from May, 1894, up to the present time (June, 1897). Some results of earlier experiments, and of preliminary efforts to find convenient methods of investigation, have from time to time been communicated to the Royal Society, the British Association, and the Glasgow Philosophical Society.*

* "On the Electrification of Air," by Lord Kelvin and Magnus Maclean, 'Roy. Soc. Proc.,' May 31, 1894, and 'Phil. Mag.,' 1894; "Preliminary Experiments to find if Subtraction of Water from Air electrifies it," by Lord Kelvin, Magnus Maclean, and Alexander Galt, 'Brit. Assoc. Report,' 1894, p. 554; "Electrification of Air and other Gases by bubbling through Water and other Liquids," by Lord Kelvin, Magnus Maclean, and Alexander Galt, 'Roy. Soc. Proc.,' February, 1895;

§ 2. The method for testing the electrification of air which was used in their earliest experiments was an application of the water-dropper,* long well known in the ordinary observation of atmospheric electricity. Its use by Maclean and Goto† in 1890 led to an interesting discovery, that air in an enclosed vessel, previously non-electrified, becomes electrified by a jet of water falling through it. An investigation of properties of matter concerned in this effect, related as it is to the "development of electricity in the breaking up of a liquid into drops" which had been discovered by Holmgren ‡ as early as 1873, and to the later investigations and discoveries described by Lenard,§ in his paper on the "Electricity of Waterfalls," forms the subject of §§ 25—37 of the present communication.

§ 3. The electrification of air by drops of water, breaking from a jet in it, or falling through it, or striking on the ground, or on water, or on metal below it, produces absolutely no practical disturbance of the electric potential measured by the water-dropper in its use for the observation of open air atmospheric electricity: but constitutes a serious objection to its application for investigating atmospheric electricity within doors, unless in a very large room or hall, and renders it altogether unsuitable for experimental investigations, such as those described in the present paper.

§ 4. The authors were, therefore, early led to abandon it: and, for testing the electrification of air, they used three different methods, one or other of which they found convenient in different cases.

Method 1. Observation of electrification of the substance receiving the electricity equal and opposite to that taken by air in any case of electrification of air.

Method 2. Observation of the electricity of an insulated metal vessel into which electrified air is introduced, or from which electrified air is removed.

"On the Diselectrification of Air," by Lord Kelvin, Magnus Maclean, and Alexander Galt, 'Roy. Soc. Proc.,' March, 1895; "On the Electrification of Air," by Lord Kelvin, 'Glasgow Phil. Soc. Proc.,' March, 1895; "On the Electrification and Diselectrification of Air and other Gases," by Lord Kelvin, Magnus Maclean, and Alexander Galt, 'Brit. Assoc. Report,' 1895, p. 630.

* Kelvin and Maclean, 'Roy. Soc. Proc.,' 1894, and Kelvin, Maclean, and Galt, 'Roy. Soc. Proc.,' February, 1895; 'Electrostatics and Magnetism,' § 262 (from 'Lit. and Phil. Soc. of Manchester Proc.,' October 18, 1859).

† "Electrification of Air by Water-jet," by Magnus Maclean and Makita Goto, 'Phil. Mag.,' August, 1890.

‡ "Sur le Développement d'Électricité à l'occasion de la Dissolution en Gouttes des Liquides," 'Kongl. Sv. Vet. Ak. Handl.,' vol. 11, No. 8, pp. 14—43 (pour l'an 1873).

§ "Ueber die Electricität der Wasserfälle," by P. Lenard, 'Annalen der Physik und Chemie,' 1892.

Method 3. Observation of the electricity taken out of air by the electric filter.

§ 5. Method 1, was used in the experiments described in their communication to the Royal Society of February, 1895, from which it was concluded that air and several other gases tried became electrified by blowing them in bubbles through water, and through solutions of various salts, acids, and alkalis, in water. This conclusion was verified for the case of common air and pure water by collecting, into a large reservoir over water, air which had been bubbled through pure water in a U-tube. The electrification of the air thus collected was tested by a water-dropper, taking the same potential as the air at the centre of the reservoir. It was thus proved that the electrification of the air was negative, as was to be expected from the positive electrification which the authors had found on insulated vessels containing water through which air had been bubbled.

§ 6. Method 2, was used in the first experiments described in the present paper (§§ 16—24) which were undertaken for the purpose of determining approximately in absolute measure the total quantity of electricity in a given mass of electrified air; and particularly for finding the greatest electrification which could be communicated to a large quantity of air by needle points supplied with electricity from an electric machine. The result thus found in § 23, $3{\cdot}7 \times 10^{-4}$ C.G.S. electrostatic, is the greatest electric density (quantity of electricity per cubic centimetre) which the authors have hitherto been able to measure in air electrified by electrified needle points. But by an electrified hydrogen flame a density of 22×10^{-4} C.G.S. electrostatic unit was obtained in air (§ 65).

§ 7. In all the other experiments described in the present paper, Method 3 was used; but probably the authors must return to Method 2 if, in future, they undertake further experiments to find the greatest electric density which they can measure in air or other gases.

"On the Change of Absorption produced by Fluorescence." By JOHN BURKE, B.A. (Dub.), Berkeley Fellow of the Owens College, Manchester. Communicated by Professor ARTHUR SCHUSTER, F.R.S. Received June 10,—Read June 17, 1897.

(Abstract.)

If a body, A, of some fluorescent substance, such as uranium glass, be transmitting light from a similar body, B, which is fluorescing, the amount of light transmitted by A from B seems quite different, according as A is fluorescing or not. There appears to